

# 2

Pink Hibiscus  
Mealybug

## Surveying for PHM

### *Introduction*

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#### Purpose

The purpose of surveying for PHM is to decide if a local population of the pest is present. If you detect the presence of PHM either by visual survey or by pheromone trapping, you should plan to begin releasing natural enemies. First, follow the procedures in this section for surveying. If the results of your survey are positive, then refer to the sections on insectary operation and releasing natural enemies. Detailed survey techniques are also discussed by Jeffrey Stibick (1997) in the *New Pest Response Guidelines for the Pink Hibiscus Mealybug*.



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## Surveying for PHM

### *Visual Survey*

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#### Introduction

Visual survey is the most effective style of survey at this time. The most common hosts found infested in the Caribbean are *Acacia* spp., cotton, hibiscus, seaside grape, and soursop. Examine these common hosts at residential sites, hotels or other commercial property, open fields, and along the seashore. If the host plants are infested, you will easily see PHM.

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#### Procedure

Look closely at the terminals on hibiscus, *Acacia* spp. and cotton, the fruit on soursop, and the junction of leaves and stem and leaf veins on seaside grape. To help identify PHM, refer to [Figure 2-11](#) and the color photographs. The white waxy covering of the various mealybug instars and white waxy filaments in the egg mass allow for easy detection. Rolling the terminal stem over sometimes reveals protective niches in which the mealybug may be residing. In heavy infestations, large quantities of egg masses may be present on the bark and main trunk of host plants such as saman, soursop, and hibiscus.

When surveyors find suspicious mealybugs that appear to have the typical field characteristics discussed in the subsection beginning on [page 2-14](#), send the specimens to a qualified taxonomist for positive identification. If the taxonomist confirms that the specimens are PHM, appropriate authorities will then announce a formal country (county or state) notification of positive identification. Prepare the specimen for identification as follows:

**Step 1**—Fill a screw-cap vial with 70 percent ethyl or isopropyl alcohol.

**Step 2**—Remove adult female mealybugs (and other instars if present) from the infested terminals, twigs, or branches using a small brush or probe.

**Step 3**—Place the mealybugs in the vial containing 70 percent alcohol.

**Step 4**—On [Form PHM-1 \(Appendix H\)](#) or a small paper label, record **in pencil** the date, location, host plant from which you collected the mealybugs, your name, and the tentative identification. Place the label inside the vial and cap the vial. **Do not use ink**—most inks dissolve in alcohol.



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## Surveying for PHM

### *Sex Pheromone Traps*

#### Introduction

The female PHM releases a sex pheromone to attract the male for mating (**Figure 2-1**). Sex pheromone traps lure the male PHM by releasing a chemical attractant (sex pheromone), either natural or synthetic, into the air. These traps may be two types:

- ◆ A trap that uses live virgin females
- ◆ A trap that uses a synthetic sex pheromone

These traps can be useful in indexing the population density of PHM in a local area. They can also be used for delimiting surveys to show presence or absence of PHM, but this requires the laborious task of identifying trapped males.



FIGURE 2-1: Male Pink Hibiscus Mealybug Mating with Female

## Procedure

### Virgin Female Trap

If sex pheromone traps with live virgin females are available, a delimiting survey could consist of setting 32 to 36 traps/mi<sup>2</sup> (12 to 14 traps/km<sup>2</sup>) in the core host plant areas in places where the traps will be safe. Trained survey personnel must have access to a key (currently under development) for identifying male PHM.

Use one trap per study site to determine the relative population density index at that site and average with other sites as appropriate.

These traps may consist of a pint-size (½-liter) paper carton, modified to hold a sprouted potato with 10 or more new virgin females (**Figure 2-2**). The trap has a vented top made of fine mesh cloth, allowing movement of the sex pheromone out of the trap to attract adult males.



FIGURE 2-2: Paper Carton Type Sex Pheromone Trap with Potato

A wire clip and trap holder (**Figure 2-3**) support a 3-in x 5-in (7.6-cm x 12.7-cm) white plastic sticky card, covered with tangle foot. Suspend the trap about 4–6 ft (1.2–1.8 m) above the ground close to the host plants (**Figure 2-4**). You can leave the trap in the field for 4 weeks and change the trap card weekly. Count male PHM on each card. This count represents a relative index of the population density of PHM at that site.

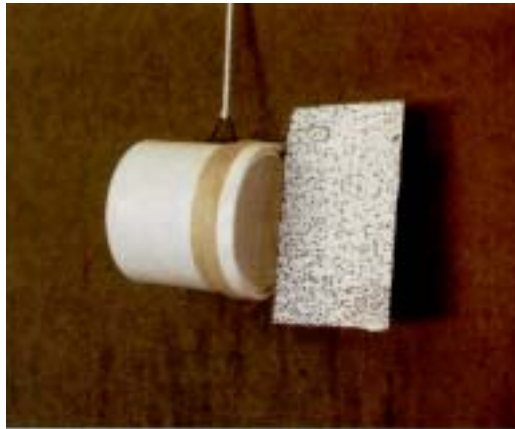


FIGURE 2-3: Sex Pheromone Trap Showing Trap Holder and White Sticky Card



FIGURE 2-4: Servicing Sex Pheromone Trap on Tree Branch of Host Plant

### Synthetic Sex Pheromone Trap

Although not currently available for PHM, synthetic sex pheromones have been developed for the citrus mealybug and Comstock mealybug.

If a synthetic sex pheromone becomes available for PHM, set the traps out in a standard grid pattern within core and buffer areas. Service the traps weekly by changing the sticky card, and replace the traps monthly.

Using a dissecting microscope, count all males on each card and record data weekly on **Form PHM-2 (Appendix H)**. The data will serve as a population density index for PHM. Keeping weekly counts of trapped males is an excellent way to track population trends and impact of natural enemies over time from their initial release.





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## Surveying for PHM

### *Distinguishing Field Characters*

#### Introduction

Use the following description (Hall, 1921) of the life stages of PHM to help identify the insect in the field. Refer also to the color photographs in this chapter and [Figure 2-11](#).

#### Identifying Life Stages

##### Nymphal Instars (Crawlers)



FIGURE 2-5: Pink Hibiscus Mealybug Nymphal Instars (arrows).

Physical characteristics of nymphal instars (crawlers) follow:

- ◆ Elongate and ovate
- ◆ Light pink color
- ◆ Well-developed legs and 6-jointed antennae
- ◆ No marginal appendages, but occasionally a little posterior cottony secretion
- ◆ Anal lobes more prominent than in the adult

## Adult Female



FIGURE 2-6: Adult Female Pink Hibiscus Mealybug (arrow).

Physical characteristics of the adult female follow:

- ◆ Length 2–3.5 mm; width 0.9–2 mm
- ◆ Reddish color; sparsely covered with white mealy wax with body color showing through
- ◆ Cottony secretion at the posterior extremity may be present
- ◆ Antennae 9-jointed, last segment pseudo-jointed, with prominent stout hair on last three segments
- ◆ Wings absent, body slightly elongate and ovate
- ◆ No lateral wax fringe
- ◆ No distinct caudal filaments

### Male puparium



FIGURE 2-7: Male Mealybug Puparium

This photograph of a Comstock mealybug male puparium shows features also characteristic of PHM. Note white filaments.

The physical characteristics follow:

- ◆ Somewhat elongated
- ◆ Formed of a very loose mass of fine white filaments
- ◆ Length 1.1–1.5 mm; width 0.35–0.45 mm

### Male 4th Instar (Pupa)

- ◆ Brownish color
- ◆ Wing sheaths developed
- ◆ Antennae directed backwards and held down close to the margin of the head and thorax
- ◆ Length 1.25 mm; width 0.4 mm

## Adult Male



FIGURE 2-8: Adult Male Pink Hibiscus Mealybug

Note caudal filaments. Physical characteristics of the adult male follow:

- ◆ Pinkish color
- ◆ Eyes and ocelli black; the lower ocelli slightly larger
- ◆ Two iridescent wings present
- ◆ Caudal filaments present; white, rather stout and as long as the rest of the insect; each filament supported by two hairs half the length of the filament
- ◆ Antennae 10-jointed, hairy; last three joints with a stout, prominent hair at the end of last three segments
- ◆ Two long, waxy, caudal filaments about as long as the body, and at the posterior end of the abdomen on each side of the 9th abdominal segment

## Female Ovisac



FIGURE 2-9: Female Ovisac

Note white, waxy mass with pink colored eggs. Physical characteristics of the female ovisac follow:

- ◆ White, about twice as long as wide, rounded at ends and roughly semicircular in cross section
- ◆ Outer shell of matted fibers; inside, many eggs arranged in a loose network of fibers









## Eggs



FIGURE 2-10: PHM Eggs.

Note small cottony filaments forming ovisac. Physical characteristics of eggs follow:

- ◆ Very light pink color, with a decidedly pink cap at one end
- ◆ Surface apparently somewhat pitted or mottled with small cottony filaments from the ovisac generally attached
- ◆ Length 0.35 mm; width 0.2 mm

<p><i>Pseudococcus maritimus</i>—Grape MB</p>  <ul style="list-style-type: none"> <li>◆ Color light pink</li> <li>◆ No longitudinal depressions</li> <li>◆ Fringe present</li> <li>◆ Body fluid reddish-brown</li> <li>◆ Egg sac irregular</li> <li>◆ Anal filaments present</li> </ul> <p>Hosts: Nursery stock, grape, <i>Malus</i>, <i>Pyrus</i>, etc.</p>	<p><i>Phenacoccus gossypii</i>—Mexican MB</p>  <ul style="list-style-type: none"> <li>◆ Color slate grey</li> <li>◆ 4 longitudinal depressions</li> <li>◆ Fringe present</li> <li>◆ Body fluid pale greenish</li> <li>◆ Egg sac very regular</li> <li>◆ Anal filaments present</li> </ul> <p>Hosts: Fuchsias, Pelargoniums, Lantanas</p>
<p><i>Pseudococcus fragilis</i>—Citrophilus MB</p>  <ul style="list-style-type: none"> <li>◆ Color pink</li> <li>◆ 4 longitudinal depressions (2 faint &amp; 2 apparent)</li> <li>◆ Fringe heavy &amp; wedge-shaped</li> <li>◆ Body fluid wine-purple color</li> <li>◆ Egg sac none</li> <li>◆ Anal filaments long</li> </ul> <p>Hosts: General nursery stock</p>	<p><i>Ferrisia virgata</i>—Striped MB</p>  <ul style="list-style-type: none"> <li>◆ Color white</li> <li>◆ 2 longitudinal depressions (broken)</li> <li>◆ Fringe heavy &amp; wedge-shaped</li> <li>◆ Body fluid light color</li> <li>◆ Egg sac none</li> <li>◆ Anal filaments present</li> <li>◆ Long, waxy dorsal threads</li> </ul> <p>Hosts: Greenhouse plants</p>
<p><i>Pseudococcus longispinus</i>—Longtailed MB</p>  <ul style="list-style-type: none"> <li>◆ Color yellow-white</li> <li>◆ 1 longitudinal depression</li> <li>◆ Fringe present</li> <li>◆ Body fluid light clear</li> <li>◆ Egg sac none</li> <li>◆ Anal filaments long</li> </ul> <p>Hosts: Greenhouse plants, <i>Pittosporum</i>, <i>Eugenia</i>, <i>Myrtus</i>, etc.</p>	<p><i>Maconellicoccus hirsutus</i>—Pink Hibiscus MB</p>  <ul style="list-style-type: none"> <li>◆ Color reddish brown</li> <li>◆ No longitudinal depressions</li> <li>◆ Fringe absent</li> <li>◆ Body fluid dark red</li> <li>◆ Anal filaments short</li> <li>◆ Egg sac irregular</li> <li>◆ Flocculent wax on dorsum</li> </ul> <p>Hosts: Hibiscus, cotton, soursop, citrus, teak, pigeon pea, guava, peanut, asparagus, beans, cocoa, etc.</p>
<p><i>Pseudococcus affinis</i>—Obscure MB</p>  <ul style="list-style-type: none"> <li>◆ Color light pink</li> <li>◆ No longitudinal depressions</li> <li>◆ Fringe present</li> <li>◆ Body fluid reddish-orange</li> <li>◆ Egg sac irregular</li> <li>◆ Anal filaments present</li> </ul> <p>Hosts: Nursery stock, grape, prickly pear, Begonia, etc.</p>	<p><i>Planococcus citri</i>—Citrus MB</p>  <ul style="list-style-type: none"> <li>◆ Color white</li> <li>◆ 1 longitudinal depression (faint)</li> <li>◆ Fringe present</li> <li>◆ Body fluid clear</li> <li>◆ Egg sac irregular</li> <li>◆ Anal filaments short</li> </ul> <p>Hosts: Citrus and very polyphagous</p>

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FIGURE 2-11: Mealybug (MB) Key: Identification of Gross Field Characteristics of Adult Females



Citrus Mealybug  
*Planococcus citri*

- ◆ color pink
- ◆ 1 stripe in middle of back
- ◆ short, slightly curved filaments around body, caudal filaments less than one-eighth length of body
- ◆ ovisac under body of female



Solenopsis Mealybug  
*Phenacoccus solenopsis*

- ◆ color dark green
- ◆ with wax removed with 2 stripes on back
- ◆ short filaments around body, caudal filaments about one-fourth length of body



Jack Beardsley Mealybug  
*Pseudococcus jackbeardsleyi*

- ◆ color gray
- ◆ without stripes on back
- ◆ thin filaments around body, caudal pair about one-half length of body or more
- ◆ ovisac covering hind part of body



Longtailed Mealybug  
*Pseudococcus longispinus*

- ◆ color grayish
- ◆ 1 stripe in middle of back
- ◆ thin filaments around body, caudal pair longer than body, second pair also long
- ◆ without an ovisac



Obscure Mealybug  
*Pseudococcus viburni*

- ◆ color pink
- ◆ without stripes on back
- ◆ thin filaments around body, caudal pair about one-half length of body or more
- ◆ ovisac covering hind part of body



Compiled by Douglass Miller, Systematic Entomology Laboratory, USDA, ARS  
National Museum of Natural History, Washington, DC 20506-0168

FIGURE 2-11: Mealybug (MB) Key: Identification of Gross Field Characteristics of Adult Females (continued)

**Pink Hibiscus Mealybug**

***Maconellicoccus hirsutus***

- ◆ color reddish brown or pink
- ◆ no markings on back
- ◆ usually without lateral filaments, sometimes with 1 or 2
- ◆ egg sac beneath body



**Pineapple Mealybug**

***Dysmicoccus brevipes***

- ◆ color pink
- ◆ no markings on back
- ◆ with 17 pairs of lateral filaments, hind filament one-fourth length of body
- ◆ without egg sac



**Striped Mealybug**

***Ferrisia virgata***

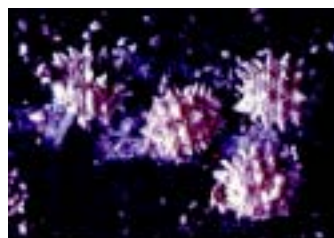
- ◆ color dark gray
- ◆ with 2 conspicuous dark stripes on back
- ◆ with 1 pair of lateral filaments, hind filament one-half length of body
- ◆ with long glassy rods on back



**Coconut Mealybug**

***Nipaecoccus nipae***

- ◆ color dark red
- ◆ without markings on back
- ◆ filament not only around margin but on back also
- ◆ without egg sac



**Papaya Mealybug**

***Paracoccus marginatus***

- ◆ color yellow
- ◆ without markings on back
- ◆ hind filament about one-fourth length of body
- ◆ egg sac under body of female



**Mexican and Madeira Mealybugs**

***Phenacoccus gossypii* & *P. madeirensis***

- ◆ color gray
- ◆ with 2 dark stripes on back
- ◆ short filaments around body, caudal filaments about one-fourth length of body
- ◆ ovisac covering body except head



FIGURE 2-11: Mealybug (MB) Key: Identification of Gross Field Characteristics of Adult Females (continued)



# 2

Pink Hibiscus  
Mealybug

## Surveying for PHM

### *Preparing Slides and Identifying Characters*

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#### Introduction

For accurate identification of PHM, use the following procedure developed by Doug Odermatt, Coccoidea specialist, PPQ. While this is not the only method, it provides a permanent mount, and may be the fastest way to clear, stain, and mount a specimen. For better clearing, boil the mealybugs in water or ethanol before preserving in ethanol.

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#### Preparing Slides

Prepare the PHM slides for identification using these steps:

**Step 1**—To clear, heat the specimen in a 10 percent potassium hydroxide (KOH) solution at 140°–150°F (60°–66°C) for about 15 minutes. Puncture larger specimens with an insect pin or make a small slit on the side of the abdomen before heating. Premix the KOH in a ratio of about 14 pellets per 50 ml of distilled water. If time is not critical, clear the specimen in cold KOH overnight. Check the calibration of your hot plate with a thermometer in a water bath.

**Step 2**—Use a spatula to pump out the body contents of the specimen until it is transparent. This is the most critical step. Briefly reheat in KOH if needed. Also, try a higher temperature if needed.

**Step 3**—Rinse in distilled water.

**Step 4**—Stain in acid fuchsin or double stain (with lignin pink). Leave specimens in stain at least 15 minutes (much longer is acceptable). Another recommended fluid for clearing/staining is Essig's aphid fluid containing stain.

**Step 5**—Rinse in 70 percent ethanol, then 95 percent ethanol.

**Step 6**—Transfer the specimen to clove oil until clear. Any remaining wax should disappear during this step. You may leave specimens in clove oil overnight.

**Step 7**—Place the specimen on a slide in a drop of Canada Balsam. Histoclear is a safe thinner for balsam. Arrange the specimens with anterior end toward you. Cover with a cover slip.

**Step 8**—Properly label each slide with the following information:

- ◆ *Maconellicoccus hirsutus* (Green)
- ◆ Collector's name
- ◆ Date collected
- ◆ Location
- ◆ Host plant

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## Identifying Characters

Refer to **Figure 2-12** for an illustration of the general morphology of an adult female mealybug (from Williams, 1996). Compare this illustration to **Figure 2-13**, *Maconellicoccus hirsutus*, and the following description of the adult female PHM (also from Williams, 1996):

### Description

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Adult female. Appearance in life described as orange pink to reddish, sparsely covered with white mealy wax but the insects become completely buried in the white ovisac material. Slide-mounted specimens up to 3.8 mm long, 2.1 mm wide; anal lobes poorly to moderately developed, each with a ventral anal lobe bar expanding towards apex and an apical seta 250–330 µm long. Antennae each usually 380–470 µm long with 9 segments. Legs well developed; hind trochanter+femur usually 300–350 µm long, rarely reduced to 280–290 µm long, hind tibia+tarsus normally 310–370 µm long, rarely only 280–300 µm long, claw stout, 35.0–37.5 µm long. Ratio of lengths of hind tibia+tarsus to hind trochanter+femur 1.00–1.16. Ratio of lengths of hind tibia to tarsus 2.30–2.60. Translucent pores present on hind femur and hind tibia, those on hind femur sometimes few and not easily apparent. Labium 150–165 µm long, about same length as clypeolabral shield. Circulus normally 85–150 µm wide, varying considerably in shape from almost quadrate to oval, usually with weak constrictions laterally and sometimes divided by an intersegmental line but this line not apparent in many specimens. Ostioles well developed, the inner edges of lips moderately sclerotized, each lip with 1–3 setae and a few trilocular pores but with marked variation. Anal ring 80–95 µm wide with 6 setae, each 125–150 µm long. Cerarii usually numbering 4–6 pairs, rarely 7 pairs. Anal lobe cerarii each with 2 conical setae, each seta about 20 µm long, and a few trilocular pores all situated on a membranous area. Anterior cerarii often similar but anteriormost cerarii sometimes reduced to a single seta or one or both setae replaced by flagellate setae.

Dorsal surface with thick flagellate setae. Multilocular disc pores absent. Trilocular pores evenly distributed. Discoidal pores minute, sparse. Oral rim tubular ducts numerous, usually each 4–5 µm in diameter, but sometimes narrower, 3.75 µm wide, 7.5–8.5 µm long, the rim about 10 µm in diameter. Oral collar tubular ducts each narrower than a trilocular pore and about 7.5 µm long, present across the middle of segments in more or less single rows but sometimes reduced to only one or two on each segment.

**Description (continued)**

Ventral surface with normal flagellate setae, similar to those on dorsum but usually longer. Multilocular disc pores each about 8.75  $\mu\text{m}$  in diameter, distributed across the anterior and posterior edges of abdominal segment IV and posterior segments, often reaching submargins; sometimes present on abdominal segment III and rarely on medial area of head. Trilocular pores present in an even distribution. Discoidal pores sparse. Oral rim tubular ducts similar to those on dorsum, present around margins of thorax and anterior abdominal segments. Oral collar tubular ducts of two sizes. A large type, narrower than a trilocular pore and about 10  $\mu\text{m}$  long, is present in transverse rows on abdominal segments III–VI and around lateral margins of all abdominal segments; others are scattered in medial and marginal areas of the thorax. A small type of duct, similar to those on the dorsum, is distributed mainly across middle of abdominal segments and mingled with the large type on margins; others are present in small numbers on head and thorax.

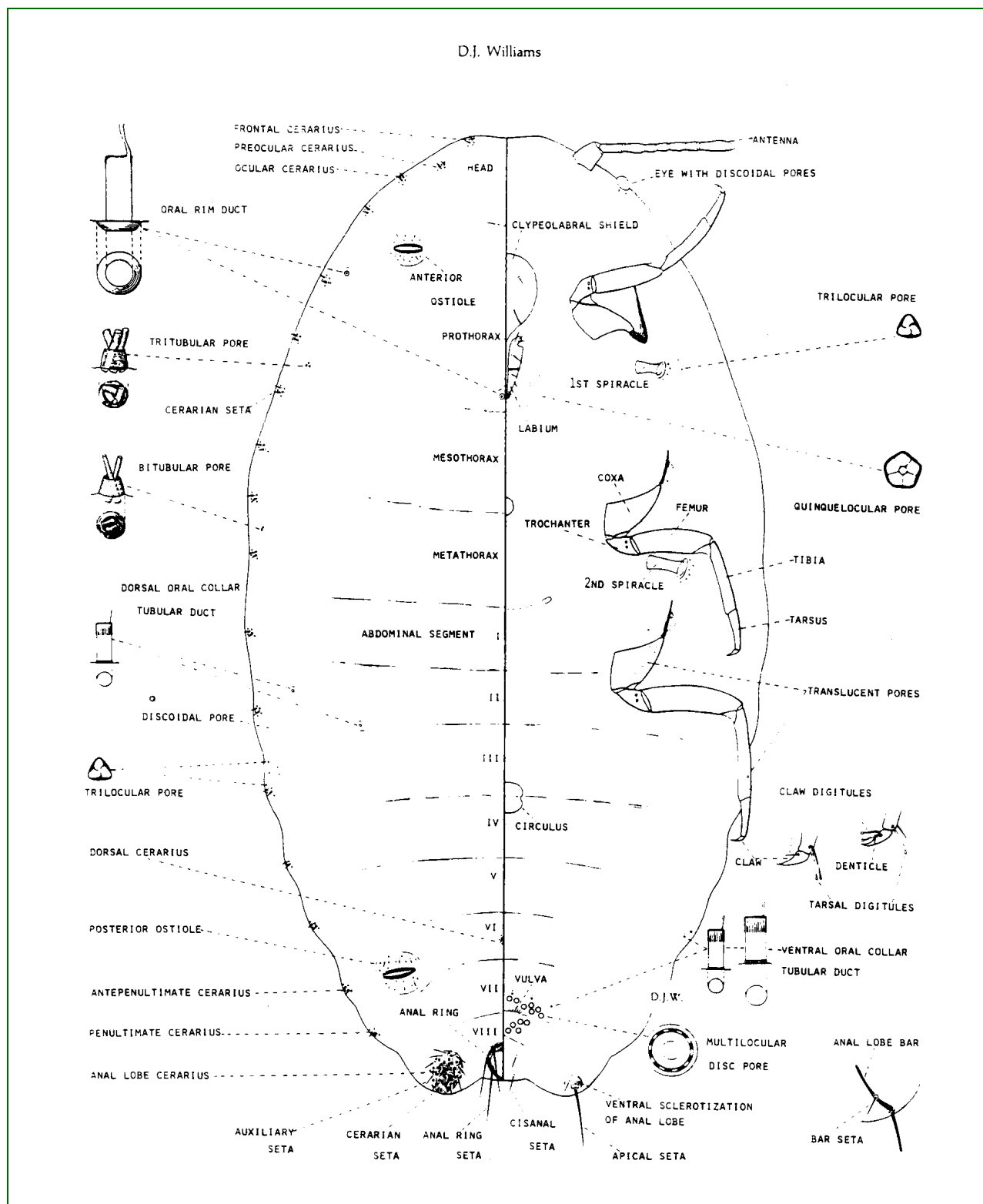


FIGURE 2-12: General Morphology of an Adult Female Mealybug (from Williams, 1996)

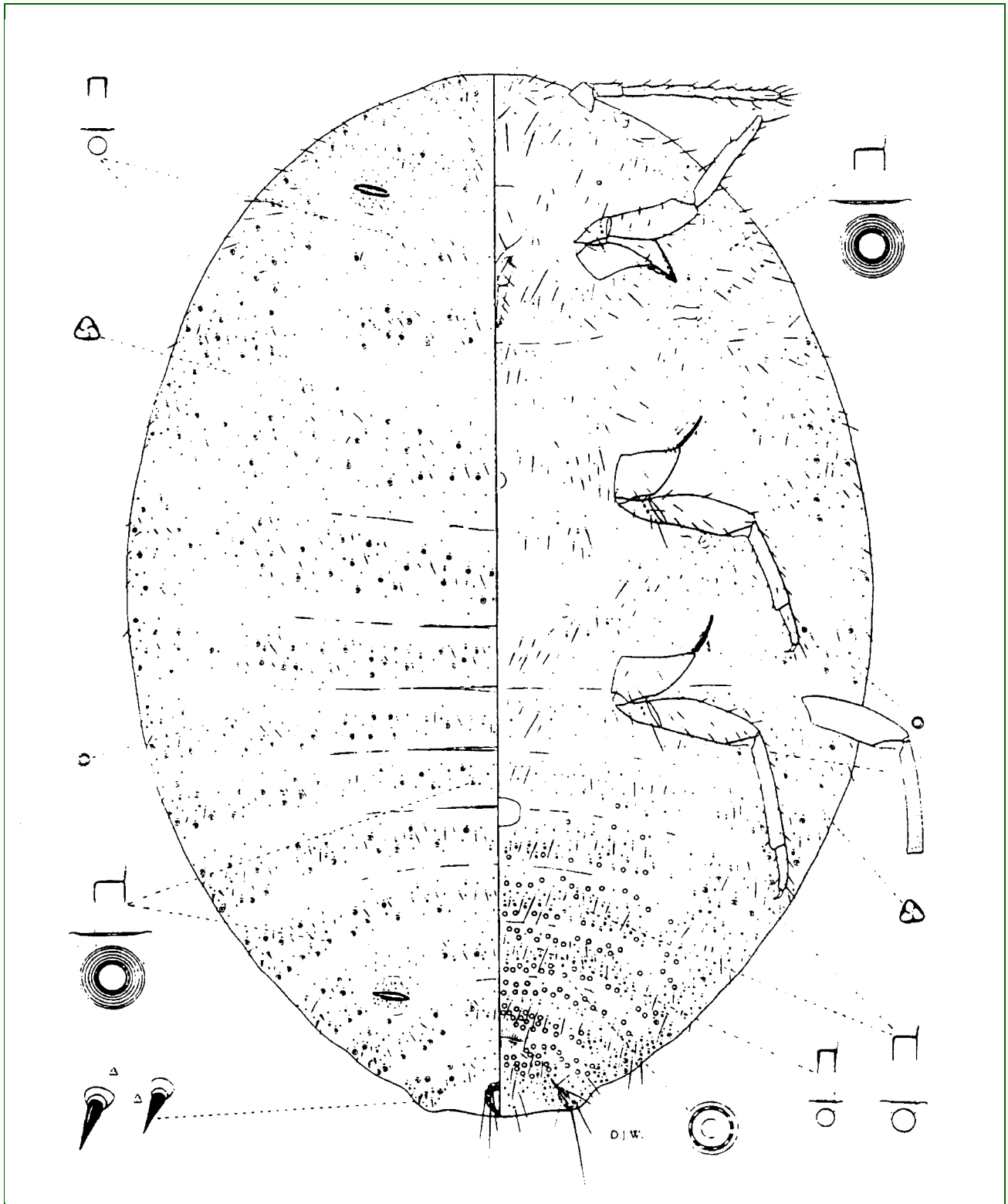


FIGURE 2-13: Pink Hibiscus Mealybug, *Maconellicoccus hirsutus* (Green) (from Williams, 1996)

